An Examination of the Summerhaven, Arizona Home Destruction Related to the Local Wildland Fire Behavior during the June 2003 Aspen Fire

Jack D. Cohen
Research Physical Scientist
USDA Forest Service
Rocky Mountain Research Station
Missoula Fire Sciences Laboratory
406-329-4821 jcohen@fs.fed.us

August 1, 2003

Summary

I examined the home destruction in Summerhaven associated with the 2003 Aspen Fire on July 31 and August 1. My examination was prompted by questions regarding the wildfire behavior related to home destruction and specifically whether homes could have survived the wildfire in the Summerhaven area. **The evidence revealed by my examination indicates that the wildfire in the Summerhaven area largely spread as a surface fire not as a high intensity crown fire. The differences in the direct flame and firebrand exposures related to the home characteristics resulted in one house surviving next to its destroyed neighbor.** Although the wildland fire largely spread on the surface, high intensity burning occurred in several locations of high structure density. The burn pattern suggests that high intensity fire spread occurred from structure to tree canopy to structure.

Examination

The Aspen Fire started on June 17, 2003 in the Santa Catalina Mountains north of Tucson, Arizona. On June 19 the fire spread into the mountain community of Summerhaven. Over 300 homes and cabins burned in association with the wildfire. Photos 1 and 2 show the character of the wildfire. Crown fire occurred in limited patches and on the slopes to the west and above the residential area.

Photos 1,2—active spreading crown fire occurred above and to the west of Summerhaven but did not spread into the residential area.

High intensity crown fire spread did not occur in the bottom of the main gulch where Summerhaven resides. Photo 3 shows the post burn situation along the main road down slope and up-wind from structure locations. Photo 4 shows surface fire spread that was typical under the conifer canopy. Although the surface fire spread does not produce high intensity burning, the intensities and durations produced significant canopy needle kill.

Photos 3,4—surface fire spread principally occurred within the Summerhaven residential area without burning in the tree canopies (crown fire).

The surface fire spread does not produce direct flame heating sufficient to ignite the wood exteriors of structures beyond about 10-15 feet. Photos 5-9 provide examples from various locations within Summerhaven that represent the destruction of the entire area.

Photo 5,6—totally destroyed homes surrounded by unconsumed tree canopies indicate that lower intensity surface fires burned in the structures' surrounding areas.

Photos 7,8,9—totally destroyed homes surrounded by unconsumed tree canopies indicate that lower intensity surface fires spread to the structures' surrounding areas.

The evidence indicates that burning homes commonly burned the adjacent and over-hanging trees. Tree canopy burning began at totally destroyed structures. In several areas of higher structure density, the evidence suggests that burning homes ignited the tree canopy that subsequently carried into adjacent structures. As each structure ignited more canopy ignited. The hillside burn pattern indicates that the ignited tree crowns originated at burning home locations. Photo 10 shows the patched pattern of destroyed homes and associated burned trees surrounded by unconsumed tree canopy. The crown fire originates and ends in association with home destruction. Photos 11-12 show the home destruction and canopy consumption within such a patch. Photos 13-14 show evidence of decreasing consumption and the charring of tree trunks and canopies as the distance away from a structure increases. Note the mottled char pattern on the tree trunks. The mottled portion is where all bark was consumed facing the burning house. The side away is charred but bark remains. Without examining the large scale patterns of home destruction associated with tree crowning and the small scale patterns of consumption, one might get the impression that the high intensity crown fire spread into the residential area and caused the destruction rather than the likely sequence of a home or homes burning leading to tree canopy fire involvement.

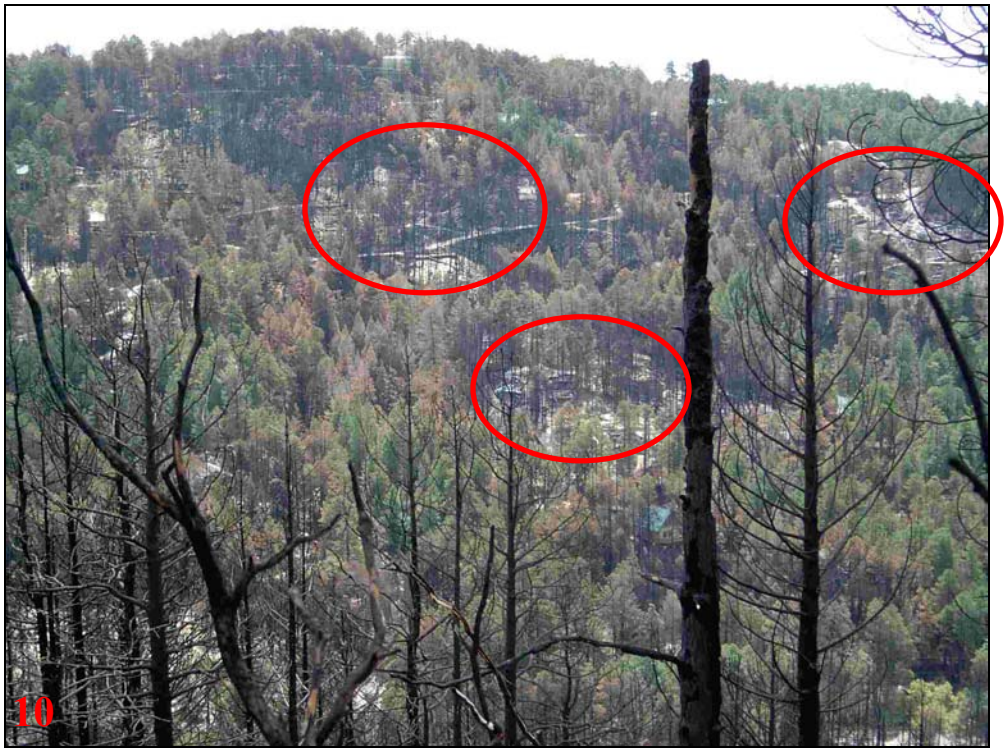
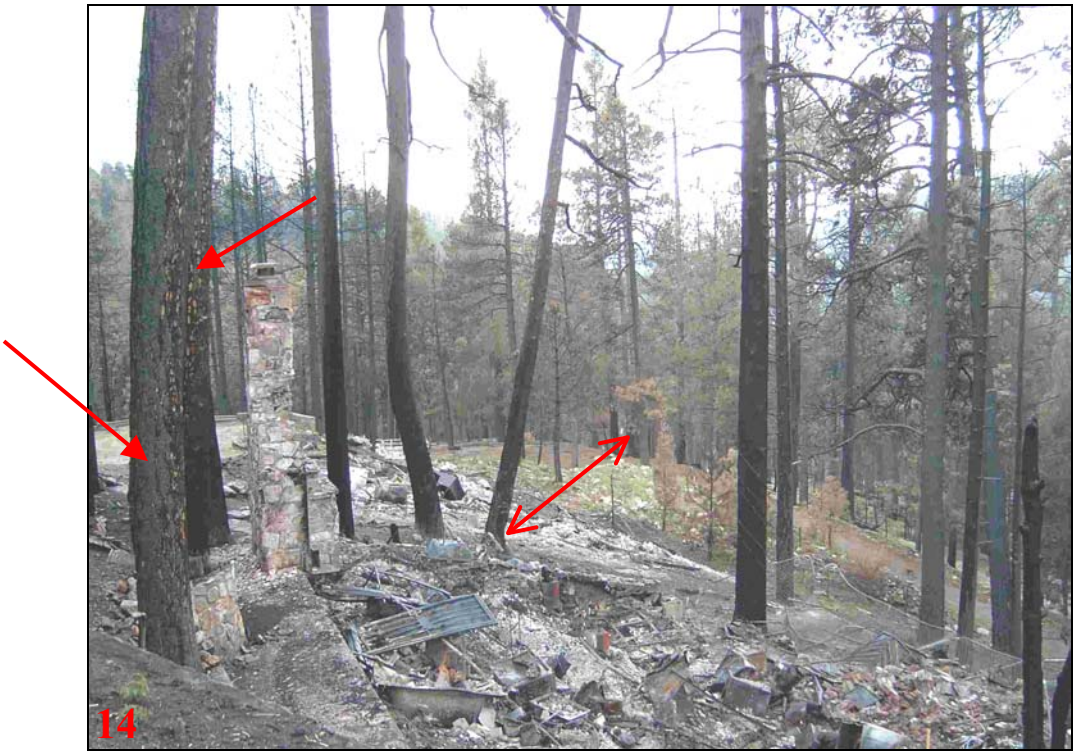


Photo 10—patches of burned trees that are associated with multiple totally destroyed homes break the largely unconsumed forest canopy. The red ovals show 3 examples of this burn pattern.

Photos 11,12—burning homes commonly burn the trees in close proximity. Where homes are close together, the trees burn around and between the homes producing areas of totally destroyed homes and associated burned tree canopies. Note the multiple homes present in each photo.



Photos 13,14—the red arrows indicate the complete bark consumption (mottled) on the side facing the burned home and char with remaining bark on the side facing away. The double ended arrow indicates the decreasing consumption and char as the distance from the burned home increases.

That leaves the question of how one home can survive adjacent to total home destruction. Photos 15-16 show such a situation. Fire does not behave capriciously; it either meets the requirements for combustion or not. If a high intensity crown fire had spread through the entire residential area then the distances between structures would not have made significant differences in the requirements for combustion. But even crown fires do not have the ability to directly ignite wood at distances greater than 100 feet. Thus, when surface fire principally occurs, the ability to directly ignite a home must occur within a few feet of or in contact with the flammable parts of the structure. A structure may ignite directly from firebrands that have come from an intense wildland fire at over ½ mile away, but these ignitions are dependent on the materials and design of the structure. Thus, significant differences in the requirements for combustion can occur from one house to an adjacent house. These differences in the direct flame and firebrand exposures related to the home characteristics result in one house surviving next to its destroyed neighbor.

Photos 15,16—homes destroyed adjacent to homes survived indicates that significant differences existed in the fire and home characteristics necessary to meet the requirements for home ignition.